The FTC's current evaluation of new restrictions on telemarketing mirrors a recent trend among U.S. states to introduce "do not call" programs It appears that seventeen states (AK, AL, AR, CO, CT, FL, GA, ID, IN, KY, LA, MO, NY, OR, TN, TX, and WI) currently have some type of no solicitations listings, most of which were introduced since 1998. Many state programs allow consumers to sign up at no cost, but several (e.g., Arkansas and Florida) have registralion charges that typically amount to Si - $10 per vear. Both sign up and renewal charges are sometimes imposed. Almost all such programs appear to allow registration via the Internet, a toll-free call, or regular mail. Many such programs exempt charitable and political calling, dnd Alabama and Missouri's programs exempt telephone companies.

Due lo their newness, the ultimate impact of manv ot these programs is difficult to assess. Participation appears to be very low in those statei that charge for the service.' A representative program is thdt of Tennessee introduced in 1999, which currently enrolls around 30% of all residential lines in the state.' This program is funded through the sale of the "do not call" list to telemarketers, who pay $500 tor it. The list is updated frequently, and fines tor violations are $5000, though few firms have been subject to sanction.'

The proliferation of "do not call" programs indicates their popularity with the public. This popularity probably arises from two logically distinct sources. First,

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For example, Arizona began its program in 1999, requires a $5 **Ire,** but appears to have a participation rate of about 1%. Oregon also charges ($6.50 new/$3 renewal) fees, and has participation of around 3.4% of eligible lines.

This information comes from the staff of the Tennessee Regulatory Authority (TRA), Nashville, Tenn.

Ordinarily, complaints are resolved through negotiation with the TRA.

abuses by telemarketers operating in a fraudulent or unethical manner have soured many un telemarketing generally. Second, even when a telemarketer acts ethically and legally, some customers are annoved bv such calls, particularly when the call comes at an inconvenient time.

Since abusive and deceptive sales praclices arc already illegal, "do not call" initiatives presumably reflect consumer annoyance with unwanted calls, rather than an effort lo prevent unlawful behavior. This phenomenon can be expressed in economic terms, and the most common economic description of this annovance is "negative externality."[6] An externalitv is a real effect borne by one person. caused by the actions of mother, thal is not reflected in prices. For example, in the absence of pollution regulations, industrial plants mav emit verv large quantities of noxious gases thal damage the health of people not involved in the operation. This can occur because, from the polluter's point-oi-view, pollution costs do not include those costs involuntarily borne bv other parties. Going further, economists show that the result of this situation is too much pollution lrom the social perspective.

The analogy from air pollution to unwanted telephone solicitations is apparent, though somewhat deceptive. Unlike pollution, which no one wishes to have, phone solicitations sometimes result in product sales ($230 billion in 1999). suggesting that *some* calls result in desirable reallocations of resources. Nevertheless, the primary economic rationale for limiting telemarketing is that such calls create negative externalities and are oversupplied in competition.

The identification of advertising (in this case, telemarketing calls) with an externality is a new wrinkle in the ongoing analysis by economists of advertising and market perlormance. A vast economic literature has evolved since the

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There are also "positive externalities." See Salanie (2000), supra, no 2

pioneering analyses of Dorfman and Steiner (1952) which addresses the problems: (i) is advertising a good thing?; (ii) what is **the** socially optimal amount of advertising?; (iii) what role does advertising play in competition?; (iv) how does advertising, or a ban on advertising. affect prices? **As** in most important questions, the economics literature has produced conflicting answers to these questions. However, it is fair to say that, at least in some important cases, advertising increases competition, lowers prices, and benefits the public. For example, Shepherd (1985, p. 317) remarks that "... advertising can be a powerful device by which new or small firms succeed ... Dial soap is a good example; it was Armour & Co.'s entry into the soap industry in the 1950s, by means of heavy advertising." Ireland (1967, p. 117) refers to the anticompetitive effects of many advertising bans with the comment. "These (studies) have generally concluded that prices are significantly higher when advertising is banned (see, for example, Benham, 1972 and Bonel et al., 1980)." Carlton and Perloff 2000 (p. 460) state that. "substantial empirical evidence indicates that advertising about prices can increase competition and raise welfare."

The economics literature has not declared advertising an unalloyed good, however, and many articles have examined the use of ads as barriers to entry, artificial product differentiation devices, and so on. Additionally, it is common to draw a distinction between "informative" advertising (e.g., ads indicating prices) and "persuasive" ads (which seek to alter preferences, perhaps even by misleading consumers).[8] In general, economists view price advertising as beneficial to consumers and oppose restrictions on it."

See Krouse (1990), Ch. 13, for an extensive review.

[8] See Shy (1995), p. 283.

See Waldham and Jensen (1998), p. 315.

The relevance of these considerations to telemarketing regulation is crucially dependent on the function such marketing performs In some industries, such as teleconimunications. telemarketing is a fundamental tool of competition. The majority of residential consumers learn about new competitive rates from direct calls to customers. Further, since virtually everyone is now presubscribed to some interLATA carrier, such calls by necessity *target the customers of rivals.* Finally, it appears that the offers made in these calls stress price reductions and other objective, economically–relevant factors such as free minutes and cash awards. In this case, then, telemarketing serves as a primary method of price competition. This fact raises concerns that limitations on such calk could raise prices generally.

Alternatively, it is true that some Lelemarketing efforts are more difficult to characterize as price competition between rivals. Calls offering products or services that consumers do not regularly purchase might fall into this category. In these cases, the effectof telemarketing on prices is somewhat more uncertain.

Economists generally have ignored these dual and sometimes conflicting properties of telemarketing. This paper serves as an initial attempt to address this void in economic research The crucial questions for this report are.

1. How is telemarketing to be modeled?

2. How would a "do not call" ban be modeled?

3 Given (i) and (ii), would such a ban be expected to raise prices'

4. Could individuals' personal support for such a ban be inconsistent with. and detrimental to, the public interest?

The remaining sections ot this report provide answers *to* these questions, and

suggest that, at least in some industries, initiatives that raise the costs or reduce the effectiveness of direct marketing will increase prices generally, and may well harm consumers.

III. A Simple Model of Telemarketing and Prices

This section explains why, in some important cases, initiatives reducing the effectiveness (or increasing the costs) of telemarketing are likely to increase prices. This conclusion arises from recognition of the use of telemarketing as a vehicle for price competition. and does not rely on unusual or complex strategic arguments. Rather, we offera very simple model, based on a two-stage duopoly game of price setting and telemarketing which illustrates the intuition behind this result. Some complications and extensions to the analyses are oiiered in Section IV.

Because the goal is to illustrate, as simply as possible, why limitations on telemarketing may harm society *even* when people find such calls generally annoying, the analysis is extremely basic. However. two critical assumptions support this investigation, and these assumptions should be emphasized since they are necessary for the results. First, **we** restrict our attention here to cases in which telemarketing is used (perhaps along with other media) to offer competing services to the customers of rival firms.

Second, the institution ot a "do not call" program is represented here as an increase in the marginal and total costs of contacting a potential customer.[10] There are several reasons for this. First, telemarketing is one ot several forms of

[10] Implicit in this assumption is that firms profit maximize and. as such, choose the optimal mix of marketing tools prior to and after the restriction

direct marketing (others include direct email, door-to-door sales, etc.), and is often used in combination with other types of advertising (e.g., television commercials and print ads). Thus, limitations on the use of telemarketing "change the mix" of advertising methods used. Since telemarketing is used now, the presumption must be that it is one of the more cost-effective means of customer contact and acquisition. Consequently, any limitation on the use of telemarketing (or any relatively more efficient acquisition tools) is presumably cost increasing, given its "revealed" effectiveness. In other words, any given level of success in customer sales will be more expensive with a ban than without one, other things equal.

The analysis presented here does not support imposing or extending any "do not call" restrictions to firms calling their own customers. This would not "even the playing field" between incumbent firms and competitors, hut rather would interfere with established business relationships and raise the cost to firms of doing business. Calls to existing customers do not constitute competitive rivalry *per se*. Customers who have explicitly indicated their interest in a firm's products by purchasing them in the past, or who otherwise have established business relatioiiships, are qualitatively different than a "random" customer. In addition, firms have a strong incentive to avoid irritating their own customers, so unwelcome calk are unlikely to be much of a danger. (Indeed, some firms, such as credit card issuers, allow customers to opt out ot such calls.) Finally, to the extent that such calls are proactive efforts to avoid losing customers. their competitive effects are desirable.

These issues addressed, we now turn to the model itself. While some technical issues are covered in the appendix, the simplicity of the analysis allows us to profitably include some of it here

We make the following assumptions. First, there are two firms, **A** and B, selling

very similar products. A large set of N consumers are initially distributed between the two sellers in numbers N_A and N_B where $N_A + N_B = N$. This distribution represents the *existing* pattern of customer relationships. For example, those N_A customers "assigned" to seller A can be viewed as presubscribed to A's service, if A were a long distance provider for example.

We assume further that each customer buys one unit of service, either from their initially assigned seller (if they do not get a "better" offer from the competition), or from the competitor (In the next section it is shown that this simplifying assumption is unnecessary.) In order to "steal" mother firm's customer, a seller must: (i) effectively contact the customer, snd; (ii) make an offer at a price at least d below that charged by the rival, where $d \geq 0$. Thus, d represents the fact that moving is costly, and customers resist switching suppliers unless there is a positive gain from doing so. This requirement is also consistent with the notion that sales calls are irritating and create a "negative bias" toward the offer, and that firm services may exhibit slight differences that are reflected in the "initial" distribution of customers.

We assume further that each unit of service costs each firm c to provide (i.e., c is marginal cost). While we consider a generalization of this in the next section, we focus here on pricing *net* of this cost c, so for now we take $c = 0$. Thus, we interpret the resulting prices as mark-tipi over unit costs

Our analysis has the following structure. First, consistent with the traditional game theory assumption, there is complete information (i.e. both firms know the description provided above and both know the other knows it, and so on). Second, the firms initially announce their service prices P_A and P_B simultaneously and non-cooperatively. These prices are public knowledge among the firms. Second, given these prices, each firm can choose to solicit sales from the *other firm's* customers ("telemarketing") Such solicitations are costly.

A customer contacted in this way will switch only if he/she is offered service at a price at least d below their current price. For example, if firm A announces a price of P_A, and firm B contacts one of A's customers, then B can obtain that customer if it offers a price of not more than P_A - d.

If S effective contacts are made (by some combination of telemarketing and other means), we assume that the cost to the conlacting firm is $(S^2K/2)$, where $K > 0$ is a pardmeter representing the costs of making effective contacts." (This formulation is not necessary, and is adopted only for convenience: *see* the Appendix for a generalization.) In general, we expect a "do not call" type ban to *increase* A since, for example, compliance with the rules will raise costs, and selective opting out may imply greater effort is required to turn up a good sales prospect. When telemarketing is made less effective, the firm will substitute other means to some extent, and these other nieans will by definition be less effective since they were not selected in the first place.

Given any set of prices P_A and P_B, the firms simultaneously and non-cooperatively select their privately optimal levels of advertising denoted S_A^* and S_B^*. These levels must satisfy the relationships:

$$S_A^* = (P_B - \delta)/K \qquad (1a)$$

$$S_B^* = (P_A - \delta)/K \qquad (1b)$$

where, by assumption, $S_A^* < N_B$ and $S_B^* < N_A$ (i.e., neither firm calls every customer of the other).

[1] This particular specification of costs exhibits diminishing marginal returns.

The conditions (1a,b) are intuitive. Firms recruit other firms' customers more intensely when: (i) the other firm charges higher prices; (ii) the discount d needed to recruit a customer is less, and (iiij the cost factor K is lower. (We assume here that $P_A - d > 0$ and $P_B - d > 0$, i.e., the margins are greater than the discount d.)

We now turn to the issue of pricing. Recall that firms select their prices (P_A, P_B) "prior" to their efforts to capture each other's customers. By a conventional economic argument, we find that optimal equilibrium price satisfy the conditions:

$$P_A^* = (KN_A + \delta)/2 \tag{2a}$$

$$P_B^* = (KN_B + \delta)/2, \tag{2b}$$

where the superscript asterisk indicates an optimal value

Several conclusions and theoretical predictions are illustrated by (2). First, firms with larger market shares charge higher prices, a consequence of the tact that having a larger ''captive" customer based to start with creates an incentive to exploit this advantage with higher prices. Second, prices are higher as d, the discount necessary to capture a customer, is higher. This is also consistent with intuition: when d is big, capturing a customer is less profitable, so there is less incentive to actively limit "raids" by other firms by ofiering lower prices to extant customers.

Our final and most significant result concerns the effect of the marketing cost index K on market prices. In particular, the higher K is, the higher prices are initial prices. This result is also easy tu understand. With "presubscribed"

ciistoniers, thcrc is an incentive to exploit the Inelasticity of their demands by charging very high prices. However, as price is increased, the number of customers lost to "raids" by the rival firm steadily increases. Thus, a lower initial price is a form ot "insurance" piirchased by the firm in order to limit competitive inroads by a rival. As K rises, such threats are lessened, and the firm exploits this tact by instituting higher initial prices. When the rival firm engages in optimal "customer stealing", the largel firm faces a tradeoff between increased profits through higher prices from each customer it retains, versus profits lost from customers who defect to the rival due *to* those same price rises.

The relevance ol thesr results for a "do not call" initiative is apparent. Siich an initiativ o would raise the cost of effective contacts, which is represented here by an increase in h. Thii, in turn, would cause prices in the market to rise. Further. although the analysis suggests that the resulting price increases will be greater for larger firms, all firms will take advantage of the ability to raise prices.

In summary, when restrictions on telemarketing raise the costs of contacting rival's customers, price competition is lessened and prices rise. This fact highlights two points. First, bans on telemarketing will not necessary reduce total advertising – it mighl onlv alter its composition toward other media.[13] Second, and most importantly, if the regulations reduce telemarketing, then the resultant diminution in objectionable calls must be weighed against the objectionable increase in prices. Thus, it *is not true that consumers will necessarilv benefit from such a policy. After nil. while some people object to sales calls, virtually everyone objects to higher prices.*

This analvsis suggests that anv initiative that raises acquisition costs, thereby

[13] **Indeed,** in the simple model of this Section, S^* rises as h rises in equilibrium because prices rise enough to increase the profitability of marketing despite the increase in K.

reducing price competition in the manner outlined here, must he evaluated verv carefully. The fact that many consumers support "do not call" initiatives as *individuals* does not establish that it is a good social policy. Indeed, since the experiences of a single individual cannot affect the market outcomc, each consumer, on his or her own, might wish not to receive sales calls (or any other advertising, for that matter). Yet, it a public policy allows everyone to satisfy this want, an important tool of competition could be disabled, with unfortunate, if unintended, consequences.

IV. Some Complications and Extensions

One may object to the analysis of the last section on several grounds. First. it should be recognized that telemarketing is here viewed primarily as a tool lor price competition. in which rivals vie to capture each other's customer.;. In this circumstance, anv initiative that raises advertising costs is anticompetitive, regardless of its other merits.

More obviously, the material of Section III makes use of several technical assumptions that are highly unrealistic. However, this section will show that, for the most part, the basic mechanism illustrated previously does not depend on these assumptions. In particular, we will consider complications based on (1) more realistic demand specification; (2) more than two iirms, and; (3) differing costs between firms.

1. Demand Complication:

The basic result of the last section – that increases in the costs of capturing rival firms' customers will result in general price increases – was obtained using an extremely simple description of consumer buying behavior. We show now that

this restriction is not necessary to the results

To maintain simplicity, suppose a consumer would buy $Q = D - p$ units ot the good when the effective price is p, where Q is units bought and D is an unknown number ($D > 0$). Again. we assume that a rival must offer a discount ot d in order to induce a consumer to switch. With this change in the specification ot consumer demand, firms now have an incentive to lower prices in order *to* sell *additional* units ot services or goods. We show that this complication does not in any way alter the basic conclusion of the previous section.

Again, the analyst5 proceeds by determining "optimal Lelemarketing" in the second stage first. Profit is maximized when $S_A = S_A^*$, $S_B = S_B^*$, where:

$$S_A^* = (D - (P_B - \delta))(P_B - \delta) / K \tag{3a}$$

$$S_B^* = (D - (P_A - \delta))(P_A - \delta) / K \tag{3b}$$

This finding is the generalization ot that given in (1), with the added complication of downward sloping demand curves. As explained in the appendix, in any equilibrium we will have the result that higher prices by the rival will trigger greater attempts to "steal" the rival's customers.

Proceeding to the first stage. the problem at hand is to show that optimal equilibrium prices increase when K increases. In other words, we need Io illustrate that restrictions on telemarketing that incredse the costs of effectively contacting others' customers will result in increased price5 for evervone Since the appendix provides a formal proot, we limit the discussion here to an intuitive explanation. We obtain the desired result whenever the effect of a price increase by firm **A,** say, on A's profit, increases when K increases. In other

words, price increases by **A** should have a more favorable impact on profits when *K* is high than when *K* is low. This is indeed the case. The reason is that, as K increases, the immediate effect is to make capturing the other firm's customers a more costly proposition. This means that the target firm can take advantage of this cost increase by raising prices. Recall that, for any firm, profits are maximized when the firm raises prices up to the point where any additional increase would cause more profits to he lost from lost customers than would be created by higher prices levied on existing customers. This optimal point involves higher prices when it becomes more costly tor the rival to "raid" the firm's customer base.

In summary, the basic mechanism found earlier – higher advertising ("telemarketing") costs cause prices to rise – is not dependent on the demand assumption made in Section 111. On reflection, it is easy to *see* why this should be *so*. Firms recognize that, the higher their prices, the greater the likelihood ot losing customers to rivals. The effectiveness of this threat, however, depends on the *costs* of contacting customers and making attractive offers *to* them. Any increase in these costs reduces competition and raises prices

2. Multiple Firms

While our analyses have focused on "duopoly", i.e., on marker' with two sellers the basic logic is not in any way dependent on that restriction. It is true, however, that models with many firms are more complex and introduce new technical issues. We briefly review these issues first, and then explain why they do not alter the conclusions established previously.

When there are many firms, each firm nidi try to "steal" customers from multiple other firms. Likewise, each firm faces threats from many firms. If a customer receives two (or more) offers d below the incumbent's price, how

would he/she choose? More importantly, how would firms target their customer recruitment (telemarketing) effortsbetween rival firms' customers?

The profit any firm earns from obtaining someone else's customer is, according lo our simplest assumptions, P_i - **d,** where P_i is the target firm's price. Given this, firms with higher prices are more attractive targets, and one expects high priced iirms to be the primary "victims" of telemarketing. This is, of course, a desirable outcome. From the analytic point-of-view, however, it is a dithcuit complication because of the abrupt effect on a firm's profits of a tiny change in its price, when by making the change, the firm moves from the highest priced to, say, the second highest priced seller in the market.

These complications do not alter the basic finding when the process of obtaining other's customers is viewed realistically. For any given firm, it is safe to say that, the higher their price, the greater the extent to which their customers obtain competing offers,and the more ciistorncrs are lost. Again, the firm's problem is to set prices to equalize the profits gamed by increases on existing customers, and profits retained by discouraging "raids" bv competing suppliers. In this sense, whether there is one rival firm or many makes no diiference. Indeed, one could regard the "other firm" in our simple model as an amalgamation of "all other firms" from the standpoint of a single seller. As long as one accepts that: (i) higher prices induce more competitive intrusions, and (ii) firms will price to equate profits gained from "unlost" customers with profits gained froni not losing customers, then increases in the costs of recruiting others' customers will increase the marginal profitability ot pricc increases. This latter eftect is that which produces our primary finding.

3. Cost Diiferences

The analyses above uniformly assume that both firms face the same costs, both

for providing service and for engaging in marketing. While firms could differ in either area, disparities in the costs of service are for more important from a policy perspective.[13] This complication can be easily analyzed using the simple framework of Section 111. Now, rather than representing prices as "prices net of service cost", price measures what the consumer pays, and each firm produces service at constant per-tinit costs of C_A and C_B, where C_A ' C_B. Repeating the previous analysis, we obtain optimal prices of:

$$P_A^* = (KN_A + \delta + C_A + C_B)/2 \tag{4a}$$

$$P_B^* = (KN_B - \delta + C_B + C_A)/2 \tag{4b}$$

These results parallel our previous findmgs. Notr that a firm charges higher prices whenever: (i) its own costs are higher, or (ii) the rivals' costs are higher. This latter effect arises because, when the rival has higher service costs, it has weaker incentives to raid other firms' customers. Note also that, iii this formulation, unit costs have the same effect on equilibrium prices as does the discount d necessary *to* get customers to switch suppliers.

Further insight into the consequences ot varying costs is obtained bv displaying the formulae for optimal customer recruitment levels, S_A^* and S_B^*. These arc'

$$S_A^* = (KN_B - \delta - (C_A - C_B))/2K \tag{5a}$$

[13] Presumably all firms can buy advertising services in a common competitive market

$$S_B^* = (KN_A - \delta - (C_B - C_A))/2K \quad (5b)$$

Equations (5) illustrate an important and policy-relevant point regarding cost diiierences. The quantity S_1^*, e.g., represents the number of customers originally using seller B who are lured to seller A by a discount of d below B's prices. If $C_A < C_B$, then more such customers are lured than if $C_A > C_B$. This is socially beneficial: firms with *higher* production costs are more vulnerable to losing ciistomers to discounts, and this is precisely what one would wish, as it saves resources and goads higher cost firms into undertaking cost-saving measures. Both benefit society.

On balance, the simple mechanism described in Section III is seen to be robust to several complications in the analysis. This is unsurprising. Firms will seek to gain rivals' customers when it is profitable to do so. Advertising, of which telemarketing is an important part, is a primary mechanism used for this purpose. Any public initiative that increases the costs of this activity will lessen the extent of competition between firms, and it is quite likely that the result will be higher prices.

V. Conclusion

This report has examined the probable economic consequences on product prices of restriclions on telemarketing for those industries in which telemarketing serves as a means "raiding" the cutomer base of a rival Telecommunications is a prominent example of such an industry, but there are others. By representing the initiation of a "do not call" program as a cost increase applicable to contacting a rival's customers, our simple, two-stage game theoretic model illustrates that the expected consequence of such restrictions is a price increase. In all cases examined, we find straightforward economic reasons to suspect that

price increases are likely

The usual economic logic favoring restrictions on telemarketing posits the existence of "externalities" created by such calls. Put simply, many consumers find such calls to be irritating, and thdt irritation is an economic cost that could be mitigated by restriclions.

The problem with the "externalitv view," however, is that it is incomplete. Advertising, which includes telemarketing, is not competitively neutral. In industries such as telecommunications, telemarketing appears responsible for most customers switching between carriers in response to offered price reductions. Limitations on telemarketing will then in turn limit an important instrumenl for price competition. While many customers do not like lo receive sales calls. all customers presumably do enjoy lower prices. Thus, limitations on telemarketuig, even if the externalitv view is totally correct, could actually *harm* consumers whenever price increases outweigh the benefits of fewer sales calls. It is critical that both phenomena be considered in any policy discussion.

Technical Appendix

This Section provides details of the analyses presented in the report. Relevant notation includes:

N_A = # customers initially assigned to firm A;

N_B = # ciistomers initially assigned to firm B;

P_A = price charged by A;

P_I = price charged by B;

d = discount necessary to induce a customer to switch suppliers;

K = effective customer contacts cost parameter.

Let unit costs of service be C_A and C_B, respectively. Initially take . . $= C_B = 0$, or else $C_A = C_B = \overline{C} > 0$ and P_A, P_A indicate prices net of $\overline{C}$. Each consumer buys one unit of servicc, either trom their initial vendor, or else at a discount of d from their initial vendor's price if effectively contacted by a rival seller.

Let S_A, S_B be the numbers of effective contacts made by firms . . respectively. A contact is "effective" if, given the contact. the customer . . switch suppliers if offered a discount of at least d. The . . firm hears for making S effective contacts is $(K . S^2)/2$, where $K > 0$ is a cost parameter. The convexity of this cost expression reflects heterogeneity among customers and short-run limitations on the ability of firm.; tu effectively advertise.

The firms play a two-stage game of complete information. In stage 1, firms

simultaneously and non-cooperatively select their prices P_A and P_B. Both firms learn these prices, and in Stage 2 simultaneously and non-cooperatively select their level: of effectivecontacts S_A and S_B. This is all common knowledge. Firms act to maximize profits. We seek a subgame perfect Nash equilibrium forprices and recruitment activities.

In Stage 2, prices are given, so firm i selects S_i to solve:

$$\max\{S_i(P_i - 6) - (KS_i^2)/2\} \tag{A1}$$

If $0 < S_i^* < N_i$, for i = A, B, then S_i^* solves

$$S_i^* = (P_i - \delta)/K \tag{A2}$$

These solutions are taken as given in the first stage of competition. It is apparent that both firmshave dominant strategies in prices. In particular, firm i selects P_i to solve

$$\max\{(Ni - S_j^*)P_i + S_i^*(P_i - 6) - (KS_i^*)/2\} \tag{A3}$$

Optimal prices P_i^*, i = A, B, are given by:

$$P_i^* = (KN_i + \delta)/2 \tag{A4}$$

Thus, $\partial P_i^*/\partial K > 0$.

When unit costs of service C_A and C_B differ, and are not both zero, we obtain the

modified conditions:

$$P_i^* = (KN_j + \delta + C_i + C_j)/2 \qquad \text{(A4')}$$

We note that, if K is sufficiently small, then $S_i^* = N_j$ is conceivable. This unrealistic possibility is not further examined.

We turn now to an analysis with downward-sloping customer demands. Let the quantity of service purchased by a customer vary with price. We assume $Q = D - p$, where Q is the number of units the customer buys, D is a known constant ($D > 0$), and p is the effective price. For simplicity, take $C_A = C_B = 0$. In this case, we have:

$$S_i^* = (D - (P_j - \delta))(P_i - \delta)/K \qquad \text{(A5)}$$

for $i = A, B$. In the first stage, we find again that the firms have dominant strategies in prices, and the subgame perfect equilibrium prices must solve:

$$(D - 2P_i + 2\delta)(D - P_i)P_i/K + (N_i - S_i^*)(D - 2P_i) = 0 \qquad \text{(A6)}$$

for $i = A, B$. For P_i^* to be a profit-maximizing choice, we require that the derivative of (A6) with respect to P_i be negative. Similarly, direct calculation establishes that the derivative of (A6) with respect to K is positive at equilibrium. Writing firm i's profits as p_i, we see that $\partial P_i^*/\partial K = -(\partial^2 p_i/\partial P_i \partial K)/(\partial^2 p_i/\partial P_i^2)$ where the numerator is negative and the denominator is negative, so that $\partial P_i^*/\partial K > 0$ as before.

Finally, we show that the particular functional form used for the costs of

contacting customers may be generalized. Instead of assuming that his cost is given by $KS^2/2$, we adopt the general form $K \cdot T(S)$ where we assume $T'(0) = 0$ (to assure contacts occur), and $T'' > 0$ (convexity of costs). Again, an increase in K raises total and marginal costs of making contacts with rivals' customers.

Let optimal advertising be given by:

$$S_A^* = S_A^*(P_B, \delta, K) \tag{A7a}$$

$$S_B^* = S_B^*(P_B, \delta, K) \tag{A7b}$$

Simple calculus establishes that $\partial S_i^*/\partial P_i > 0$, $\partial S_i^*/\partial d < 0$, and $\partial S_i^*/\partial K < 0$. Moving again to the first (price) stage, we obtain the necessary conditions:

$$-(\partial S_B^*/\partial P_A)P_A + (N_A - S_B^*) = 0 \tag{A8a}$$

$$-(\partial S_A^*/\partial P_B)P_B + (N_B - S_A^*) = 0 \tag{A8b}$$

Noting that the Jacobean matrix $[\partial^2 p_i/\partial P_i \partial P_j]$, where p_i is i's profit, has zero off-diagonal elements, and calculating the terms $[\partial^2 p_i/\partial P_i \partial K]$, application of Cramer's Rule allows us to determine the sign of the derivatives $\partial P_A^*/\partial K$ and $\partial P_B^*/\partial K$. These are positive. For example,

$$\partial P_A^*/\partial K = (-2\partial S_B^*/\partial K(\partial 2T(S_A^*)/\partial S_A^*))/|J| = 0$$

where $J = [\partial^2 p_i/\partial P_i \partial P_j]$ is the Jacobean, so that $|J| > 0$ at P_A^*, P_B^*. Thus,

$$\P P_A^* / \P K > 0$$

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